CLAIMS

Therefore, having thus described the invention, at least the following is claimed:

1. A method of fabricating a piezoelectric resonator from a semiconductor-on-insulator substrate, the method including:

forming trenches in a semiconductor layer of the semiconductor-on-insulator substrate;

removing an oxide layer from the semiconductor-on-insulator substrate;

applying a piezoelectric material to the semiconductor layer; and

providing an electrode to the piezoelectric material.

2. The method of claim 1, further including patterning the piezoelectric material.

3. The method of claim 2, wherein the patterning includes wet etching using ammonium chloride.

4. The method of claim 1, wherein the piezoelectric material is one of zinc oxide, aluminum nitride, and lead zirconate titanate.

5. The method of claim 1, wherein the applying includes applying a thin film.

6. The method of claim 1, wherein the applying includes one of sputtering and high temperature growth.

7. The method of claim 1, wherein the forming trenches includes one of deep reactive ion etching and regular reactive ion etching.

8. The method of claim 1, wherein the forming oxide includes using hydro-fluoric acid.

9. The method of claim 1, wherein the providing includes depositing aluminum using electron beam evaporation.

10. The method of claim 1, wherein the forming, applying, and providing includes a three-mask process.

11. The method of claim 1, wherein the forming, applying, and providing occurs at a temperature of less than 250 C.

12. The method of claim 1, wherein the semiconductor material includes one of silicon, germanium, single crystal semiconductor material, polycrystalline semiconductor material, and amorphous semiconductor material.

13. A piezoelectric resonator, including:

a semiconductor material;

an electrode; and

a piezoelectric material disposed between the semiconductor material and the electrode.

14. The piezoelectric resonator of claim 13, further including an oxide layer adjacent to the semiconductor material.

15. The piezoelectric resonator of claim 14, further including a handle layer adjacent to the oxide layer, wherein the oxide layer is disposed between the handle layer and the semiconductor material.

16. The piezoelectric resonator of claim 15, further including a capacitor connecting the semiconductor material to the handle layer, wherein the capacitor is configured to receive a direct current voltage.

17. The piezoelectric resonator of claim 13, further including, in response to an excitation force, a quality factor for a beam configuration that ranges between approximately 2400-6200 for resonance frequencies ranging between approximately 1.72 megahertz –6.7 mega-hertz.

18. The piezoelectric resonator of claim 13, further including, in response to an excitation force, a quality factor for a beam configuration that ranges between approximately 3000-6200 for resonance frequencies ranging between approximately 1.72 megahertz – 4.87 mega-hertz.

19. The piezoelectric resonator of claim 13, further including, in response to an excitation force, a quality factor for a beam configuration that ranges between approximately 5300-6200 for resonance frequencies ranging between approximately 1.72 megahertz –3.29 mega-hertz.

20. The piezoelectric resonator of claim 13, further including, in response to an excitation force, a quality factor for a beam configuration that ranges between approximately 5400-6200 for resonance frequencies ranging between approximately .721 megahertz – 1.72 mega-hertz.

21. The piezoelectric resonator of claim 13, further including, in response to an excitation force, a quality factor for a block configuration that ranges between approximately 5500-11,600 for resonance frequencies ranging between approximately 16.9 megahertz – 195 mega-hertz.

22. The piezoelectric resonator of claim 13, further including, in response to an excitation force, a quality factor for a block configuration that ranges between approximately 4700-11,600 for resonance frequencies ranging between approximately 16.9 megahertz – 195 mega-hertz.

23. The piezoelectric resonator of claim 13, further including, in response to an excitation force, a quality factor for a block configuration that ranges between approximately 4500-11,600 for resonance frequencies ranging between approximately 16.9 megahertz – 195 mega-hertz.

24. The piezoelectric resonator of claim 13, wherein the semiconductor material, the electrode, and the piezoelectric material are configured in one of a beam configuration and a block configuration.

25. The piezoelectric resonator of claim 13, wherein the electrode includes one of a sense electrode and a drive electrode.

26. The piezoelectric resonator of claim 25, wherein the sense electrode and the drive electrode are separated by the piezoelectric material.

27. The piezoelectric resonator of claim 25, wherein the sense electrode and the drive electrode are separated by the surface of the semiconductor material.

28. The piezoelectric resonator of claim 13, wherein the thickness of the semiconductor material ranges between approximately 0.2-30 microns.

29. The piezoelectric resonator of claim 13, wherein the piezoelectric material includes one of zinc oxide, aluminum nitride, and lead zirconate titanate.

30. The piezoelectric resonator of claim 13, wherein the semiconductor material includes one of silicon, germanium, single crystal semiconductor material, polycrystalline semiconductor material, and amorphous semiconductor material.

31. The piezoelectric resonator of claim 13, further including an adhesion layer disposed between the piezoelectric material and the semiconductor material.

32. The piezoelectric resonator of claim 13, further including at least one of in-plane and out-of-plane voltage tunability.

33. A communications device, including:

a receiver; and

a piezoelectric resonator disposed in the receiver, the piezoelectric resonator including:

a semiconductor material;

an electrode; and

a piezoelectric material disposed between the semiconductor material and the electrode.

34. The communications device of claim 33, wherein the piezoelectric resonator is configured as at least one of a filter and a frequency reference device.

35. The communications device of claim 33, further including a transmitter.

36. The communications device of claim 35, wherein the transmitter includes a second piezoelectric resonator, wherein the second piezoelectric resonator is configured as at least one of a filter and a frequency reference device.